

# PATENT ABSTRACTS OF JAPAN

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(71)Applicant : **CANON ELECTRON INC**

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(72)Inventor : **YOSHIKAWA MUNETOSHI  
KAWAKAMI YOSHIO  
NOZUE HITOSHI**

## (54) LIGHT QUANTITY STOPPING DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a plastic filter which has sufficient strength of its surface to sliding and has the performance as an ND filter by using the filter formed with inorg. hard films on one or both surfaces of a plastic base plate.

SOLUTION: The filter formed with the inorg. hard films on one or both surfaces of the plastic base plate is used for the light quantity stopping device having plural diaphragm vanes and the plastic ND filter for light quantity adjustment to be arranged in at least part within the aperture formed by these diaphragm vanes. The hard film forming materials are preferably SiO<sub>x</sub> (x=1 to 2), MgF<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, etc. The methods of forming the hard films are preferably vacuum vapor deposition, ion plating, etc. The film thicknesses of the hard films are generally preferably 1.0 to 0.5μm. As a result, the light quantity stopping device has the sufficient strength to sliding contact and can maintain the performance as the ND filter in a wavelength region of 400 to 700nm.



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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the quantity of light collimator suitable for using it for motion picture camera machines, such as a video camera.

[0002]

[Description of the Prior Art] The organic coloring matter or the pigment which absorbs light in the ingredient [cellulose acetate, PET (polyethylene terephthalate), a vinyl chloride], etc. which makes the shape of a film as an ND (neutral density) filter currently used for the conventional quantity of light collimator is mixed, and the thing of the type which applies the color or pigment which absorbs light to the thing of the type to scour and said ingredient is used. ND filter 1 and the diaphragm wing 2 which are a part for the principal part of a quantity of light collimator have taken the configuration as shown in drawing 1. It is mentioned that the quantity of light collimator shown in 1 of drawing 2 is thinly producible as main reasons which are using plastic film. Consequently, in the optical sectional view shown in drawing 2, spacing of lens 2A and lens 2B can be shortened, and it becomes possible to obtain the image of a high scale factor.

[0003] Incidentally, 1A, 1B, 1C, and 1D constitute the quantity of light collimator 1 from drawing 2, and 1A is an ND filter and the diaphragm wing which 1B and 1C drive relatively (here, it moves in opposite), and, as for two drawing wings, forms opening of magnitude which carries out adjustable by the \*\*\*\* system. The ND filter is pasted up on one of diaphragm wings. 1D is a diaphragm wing support plate. Moreover, 4 is a component lens with which 2A, 2B, 2C, and 2D constitute the photography optical system 2, and 3 is a solid state image sensor in a low pass filter.

[0004]

[Problem(s) to be Solved by the Invention] However, since a front face is plastics, in case a quantity of light diaphragm slides on the ND filter made from plastics attached in the diaphragm wing according to the light and darkness of \*\*\*\*, a diaphragm wing and a diaphragm wing support plate, and an ND filter will rub, and a crack will produce it on an ND filter front face. The problem that resolution will fall owing to the crack has occurred as the sensibility of an image sensor rises in recent years.

[0005] Therefore, this invention is offering the technical problem the collimator with reinforcement with the sufficient front face to sliding of said plastics filter, and the engine performance as an ND filter.

[0006]

[Means for Solving the Problem] This invention is a quantity of light collimator characterized by said filter being a filter with which the inorganic hard film is formed in one side or both sides of a plastic plate in the quantity of light collimator equipped with the ND filter made from plastics for the quantity of light adjustment arranged at least at the part in opening formed by two or more drawing wings which drive relatively, extract and carry out adjustable [ of the magnitude of opening ], and said drawing wing.

[0007] Although forming only in one side is desirable as for the inorganic hard film formed in a plastic plate front face, when a crack occurs to ND filter both sides by sliding, it is necessary on the design of an collimator to form it in both sides from a viewpoint of cost.

[0008] An ND filter front face has sufficient reinforcement to sliding contact into the wing part at the time of closing motion of an collimator, and the quantity of light collimator of this invention fully has the engine performance as an ND filter in 400nm - 700nm of wavelength fields of the light.

[0009]

[Embodiment of the Invention] as a hard film morphogenetic substance -- SiO<sub>x</sub> (x=1-2) and MgF<sub>2</sub> And aluminum 2O<sub>3</sub> etc. -- it is desirable and vacuum deposition, ion plating, etc. are desirable as the formation approach of the hard film. Moreover, generally the thickness of the hard film has 1.0 micrometers - desirable 0.05 micrometers.

[0010] (Example 1) The inorganic hard film of 0.1 micrometers of thickness was first formed with the vacuum deposition method on the ND filter with a thickness of 100 micrometers by which organic coloring matter was scoured. Vacuum deposition could control thickness comparatively easily, and could control the optical property, and since it excelled as an approach further of forming membranes at low temperature, it chose it. The acquired membrane structure is shown in drawing 3. As the quality of the material of an ND filter, heat-resistant temperature (T<sub>g</sub>) chose PET or PEN (polyethylenenaphthalate) with low moisture absorption highly. It is MgF<sub>2</sub> in which a degree of hardness is high and has sufficient reinforcement to sliding of an collimator as a hard film morphogenetic substance compared with plastic film far. Or SiO<sub>2</sub> It chose. Since these thin films are matter without the absorption of light, they also have the advantage which can also hold the permeability property of an ND filter.

[0011] When extracting the produced ND filter and pasting a wing, the configuration of a filter was made into right-and-left asymmetry in order to make distinction of an adhesion side easy. Moreover, in order to extract as an ND filter and to secure sufficient adhesive property of a wing, the hard film was not formed in a part for jointing of an ND filter, but it considered as the condition that a plastics front face is exposed.

[0012] In order to check the reinforcement on the front face of an ND filter produced by the above approach, it actually attached in the quantity of light collimator, and deed sliding of the closing motion of a diaphragm was carried out 250,000 times.

Consequently, in the hard thin film front face of the ND filter which formed the hard film with vacuum deposition, it checked that the crack had not occurred ( drawing 4 (a) ). In addition, it checked that the crack had generated the same trial greatly on the osculating orbit of a diaphragm wing and an ND filter when the ND filter made from plastics in which the hard film is not formed is followed ( drawing 4 (b) ). The quantity of light collimator which has sufficient reinforcement from the above-mentioned result to sliding contact with the hard film formed with vacuum deposition was producible.

[0013] (Example 2) Next, in order to simplify an ND filter production process, the hard film morphogenetic substance was chosen and the hard film which has a function as an ND filter on PET or a PEN substrate with a transparent thickness of 100 micrometers was formed. By this approach, organic dye scours and the production process of an ND filter can be shortened at the single process of only vacuum evaporation of the hard film from two processes of vacuum evaporation of the hard film.

[0014] The acquired membrane structure is shown in drawing 5 . Since the degree of hardness was high enough compared with a plastics front face, any film morphogenetic substance was chosen. Furthermore, they are the 2nd, 4, and TiO<sub>2</sub> of six layers. The matter which has the function which lowers permeability was chosen as the layer (y=1-2). Permeability changes with the total thickness of three layers, and permeability falls, so that it becomes thick. Moreover, the neutral nature of the permeability in wavelength within the limits of 400nm - 700nm is Above TiO<sub>2</sub>. It changes with the y of a film presentation. In order to make permeability neutral by said wavelength within the limits, it is desirable to set the value of y as 1.2 and to form membranes. When the value of y is smaller than 1.2, there is an inclination for the permeability in the wavelength range of 400-550nm to decrease especially. Moreover, in being larger than 1.2, permeability increases in [ wavelength ] 400-550nm, and there is an inclination for neutral nature to get worse. 1, 3, and five layers -- aluminum 2O<sub>3</sub> it is -- TiO<sub>2</sub> When the laminating was carried out by suitable thickness, it chose from having the property to reduce the reflection factor in the wavelength range of 400nm - 700nm. The hard film which has a function as an ND filter as mentioned above is constituted, and it is MgF<sub>2</sub> like an example 1 on it. Or SiO<sub>2</sub> It formed. Here, the thickness of each class could be layer [ 1st ] : 0.095 micrometers, layer [ 2nd ] : 0.053 micrometers, layer [ 3rd ] : 0.035 micrometers, layer [ 4th ] : 0.047 micrometers, layer [ 5th ] : 0.053 micrometers, layer [ 6th ] : 0.018 micrometers, and layer [ 7th ] : 0.096 micrometers.

[0015] The sliding trial was performed like [ ND filter / which was produced ] the example 1. Consequently, the hard film front face of an ND filter was what a crack does not occur but has sufficient reinforcement to sliding contact ( drawing 6 ).

[0016] In addition, the permeability of the produced ND filter shows fixed permeability in 400nm - 700nm of wavelength fields, as shown in drawing 7 , and it is excellent in flat nature. The reflection factor shows the sufficiently low value in the above-mentioned wavelength field, as shown in drawing 8 , and it can permit it enough as an ND filter.

[0017] As stated above, by forming the inorganic hard film on a plastic plate, this invention has sufficient reinforcement to sliding contact into the wing part at the time of collimator closing motion, and can offer the quantity of light collimator which has the engine performance as an ND filter in 400nm - 700nm of wavelength fields.

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[Translation done.]

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CLAIMS

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[Claim(s)]

[Claim 1] The quantity of light collimator characterized by said filter being a filter with which the inorganic hard film is formed in one side or both sides of a plastic plate in the quantity of light collimator equipped with the ND filter made from plastics for the quantity of light adjustment arranged at least at the part in opening formed by two or more drawing wings which drive relatively, extract and carry out adjustable [ of the magnitude of opening ], and said drawing wing.

[Claim 2] The quantity of light collimator according to claim 1 said whose inorganic hard film is film formed by vacuum deposition.

[Claim 3] the outermost layer morphogenetic substance of said inorganic hard film -- SiOx Or MgF2 it is -- quantity of light collimator according to claim 1.

[Claim 4] The quantity of light collimator according to claim 1 whose quality of the material of said plastic plate is PET or PEN.

[Claim 5] Said inorganic hard film is TiOy. A layer and aluminum 2O3 Quantity of light collimator according to claim 1 which is the film which has a layer.

[Claim 6] The quantity of light collimator according to claim 1 whose configuration of said filter is right-and-left asymmetry.

[Claim 7] The quantity of light collimator according to claim 1 which is the filter with which the inorganic hard film is not formed on the plastic plate at a part for jointing with the drawing wing of said filter.

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**DESCRIPTION OF DRAWINGS**

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[Brief Description of the Drawings]

[Drawing 1] The perspective view showing a part for the principal part of a quantity of light collimator.

[Drawing 2] An optical sectional view to show the operation when allotting an ND filter to a photography system.

[Drawing 3] Drawing showing the hard membrane structure in the example 1 of this invention.

[Drawing 4] The schematic diagram on the front face of an ND filter after the sliding trial performed in the example 1 of this invention.

[Drawing 5] Drawing showing the hard membrane structure of the vacuum evaporation ND filter in the example 2 of this invention.

[Drawing 6] The schematic diagram on the front face of an ND filter after the sliding trial performed in the example 2 of this invention.

[Drawing 7] The spectral transmittance measurement result measured in the example 2 of this invention.

[Drawing 8] The spectral-reflectance measurement result measured in the example 2 of this invention.

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[Translation done.]

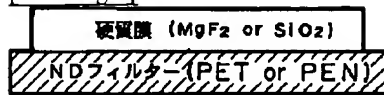
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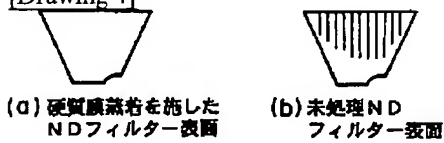
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DRAWINGS

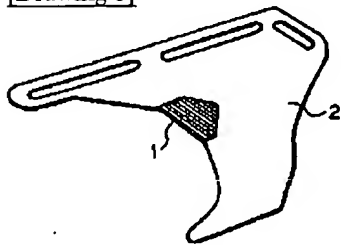
[Drawing 3]



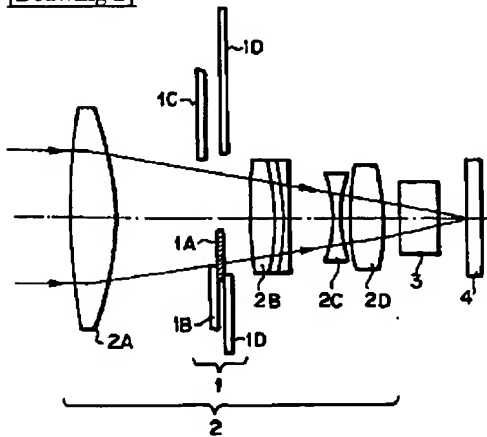
[Drawing 4]



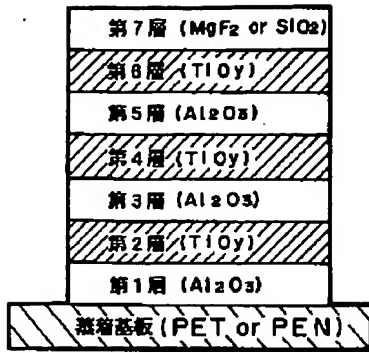
[Drawing 1]



[Drawing 2]

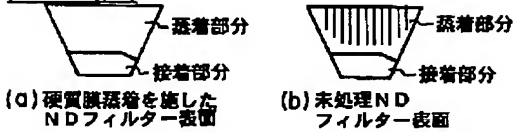


[Drawing 5]

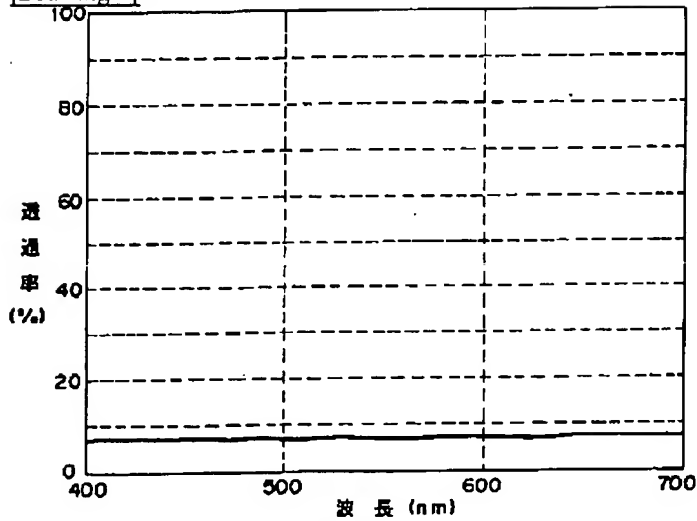


蒸 NDフィルターの膜構造 (全7層)

[Drawing 6]

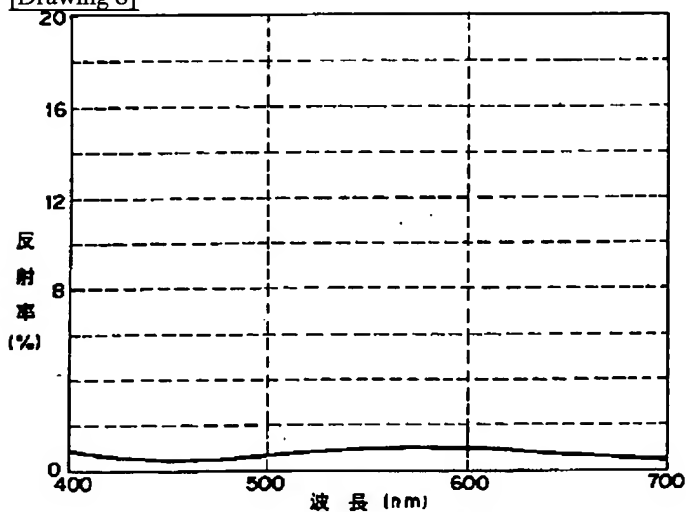


[Drawing 7]



作製したNDフィルターの分光透過率

[Drawing 8]



作製したNDフィルターの分光反射